UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/929,280	08/13/2001	David J. Edlund	NPW 318	8195

23581 7590 09/06/2005

KOLISCH HARTWELL, P.C.
520 S.W. YAMHILL STREET
SUITE 200
PORTLAND, OR 97204

EXAMINER	
CREPEAU, JONATHAN	
ART UNIT	**PAPER NUMBER**
1746	

DATE MAILED: 09/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/929,280	EDLUND ET AL.	
	Examiner	Art Unit	
	Jonathan S. Crepeau	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *6/20/05*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-21,23-29,31-44 and 48-62* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5-21,23-29,31-44 and 48-62* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/16/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office action addresses claims 1-3, 5-21, 23-29, 31-44, 48-58, and newly added claims 59-62. All claims are newly rejected under 35 USC 103, as necessitated by amendment. Accordingly, this action is made final.

Claim Objections

2. Claim 58 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 58 recites an electrochemical compressor, which is recited in claim 1. Correction is required.

Claim Rejections - 35 USC § 103

3. Claims 1-3, 5-10, 17, 21, 23-28, 31-33, 37-39, 48-51 and 54-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 9-306531 in view of Bloomfield (U.S. Patent 5,900,031).

Regarding claim 1, JP '531 teaches a fuel processor (10), a hydrogen storage tank (50), a mechanical compressor (51) between the processor and the storage device, and a fuel cell stack

(30) (see Fig. 1; paragraph [0022] of the machine translation). The fuel cell stack is adapted to simultaneously receive both compressed and uncompressed hydrogen. Regarding claims 2 and 3, the compressed stream and the pre-compressed stream have the same composition. Regarding claim 9, a valve regulates the pressure of the hydrogen supplied to the tank (see Fig. 1). Regarding claims 21 and 23, the system comprises a controller for controlling the amount of hydrogen delivered to the hydrogen supply and fuel cell (see [0030]). Regarding claims 24 and 25, the hydrogen is regulated in response to the applied load (71). Regarding claims 38 and 39, the controller is computerized and comprises a read-only memory (see [0028]). Regarding claim 49-51, the hydrogen storage device may comprise a hydride bed that may be subjected to a temperature gradient (see [0023]).

However, the reference does not expressly teach the presence of an electrochemical compressor, as recited in claim 1.

Bloomfield is directed to hydrogen production system comprising an autothermal reformer and an electrochemical compressor (see abstract).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the electrochemical compressor of Bloomfield in the system of JP '531. As would be appreciated by the artisan, electrochemical compressors produce high-pressure hydrogen in an efficient and reliable manner (e.g., since there are no moving parts). As such, the artisan would be motivated to use the electrochemical compressor of Bloomfield in the system of JP '531.

JP '531 further does not expressly teach that the components are integrated in a common housing (claims 6 and 8). The reference further does not expressly teach that the hydrogen delivery is controlled responsive to the hydrogen pressure or the quantity of hydrogen in the storage device (claims 26, 28, and 31).

However, regarding claims 6 and 8, these claims are also not considered to be distinguished over JP '531. The claims merely recite that the components are fully or partially integrated in a common housing. However, it has been held that making integral or portable is generally not considered to impart a patentable distinction. See MPEP §2144.04.

Regarding claims 26, 28, and 31, the reference fairly suggests these limitations. The reference generally teaches that the pressure and amount of stored hydrogen are regulated in the operation of the fuel cell (see, e.g., paragraph [0028]). As these values are important in the operation of the system, it would be obvious to measure these values and incorporate them into the control scheme to obtain an even more precise control of the system. As such, claims 26, 28, and 31 would also be rendered obvious.

4. Claims 34-36 and 40-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '531 in view of Bloomfield as applied to claims 1-3, 5-10, 17, 21, 23-28, 31-33, 37-39, 48-51 and 54-57 above, and further in view of Colborn (U.S. Patent 6,522,955).

JP '531 does not expressly teach that the controller comprises a wired or wireless communication linkage (claims 34-36). The reference further does not expressly teach that the controller comprises an interface capable of having a user input (claims 40-44).

Colborn is directed to a system and method for power management. The system comprises a communication device (i.e., controller) (102). The device comprises a display (600), user input (404), memory (608) and a wired or wireless linkage (see col. 8, lines 37-49; col. 10, line 7 et seq.).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the control device of Colborn in the system of JP '531. In column 4, line 10, Colborn teaches that it is an object of the invention is "to provide a power management system that is compact, efficient, and easy to use." As such, the artisan would be motivated to use the control device of Colborn in the system of JP '531.

5. Claims 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '531 in view of Bloomfield as applied to claims 1-3, 5-10, 17, 21, 23-28, 31-33, 37-39, 48-51 and 54-57 above, and further in view of Skoczylas et al (U.S. Patent 6,666,961).

JP '531 does not expressly teach that the hydrogen storage device comprises a carbon nanotube bed, as recited in claims 52 and 53.

Skoczylas et al. is directed to an electrochemical cell. In column 8, line 52, the reference teaches that "[t]he hydrogen produced hereby can be stored as high-pressure gas, or alternatively, in a solid form, such as a metal hydride, a carbon based storage (e.g. particulates, nanofibers, nanotubes, or the like)."

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosure of Skoczylas et al. indicates that carbon nanotubes are functionally equivalent to high-pressure gas tanks and metal hydrides for storing hydrogen. As such, it would be obvious to substitute the carbon nanotubes of Skoczylas et al. for the tank or metal hydride of JP '531. An express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982); MPEP §2144.06.

6. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '531 in view of Bloomfield as applied to claims 1-3, 5-10, 17, 21, 23-28, 31-33, 37-39, 48-51 and 54-57 above, and further in view of Wojtowicz et al (U.S. Pre-Grant Publication No. 2002/0041986).

JP '531 does not expressly teach that the hydrogen is produced via pyrolysis.

Wojtowicz et al is directed to a method of producing hydrogen comprising the steps of pyrolysis and steam reforming (see Fig. 1).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the

pyrolysis/steam reforming method of Wojtowicz et al. in the system of JP '531. Wojtowicz et al teaches the following in paragraph 20:

> **[0020]** It is also an object of the invention to provide a power system wherein hydrogen gas for use in a fuel cell is produced from a hydrocarbonaceous material, and wherein the system may be self-contained and implemented in a transport vehicle.

Therefore, the artisan would be motivated to use the pyrolysis/steam reforming method of Wojtowicz et al. in the system of JP '531.

7. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '531 in view of Bloomfield as applied to claims 1-3, 5-10, 17, 21, 23-28, 31-33, 37-39, 48-51 and 54-57 above, and further in view of Jones (U.S. Patent 6,686,078).

JP '531 does not expressly teach that the measured operating parameters include the "operating state" of the fuel processor, as recited in claim 29.

Jones is directed to a method of operating a reformer. The method employs sensors (64, 43) for detecting fuel flow to the reformer (e.g., an "operating state" of the reformer) and the flowrate of hydrogen from the reformer, and a regulator (45) for regulating hydrogen flow to the fuel cell (see Fig. 1).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to use the sensors of Jones in the system of JP '531. In column 1, line 58, Jones teaches the following:

> **Thus, there is a need for an efficient method and fuel cell system which inhibits the flooding of fuel cells particularly in periods of low electrical demand.**

As such, the artisan would be sufficiently motivated to use the sensors of Jones in the system of JP '531.

8. Claims 11-16, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '531 in view of Bloomfield as applied to claims 1-3, 5-10, 17, 21, 23-28, 31-33, 37-39, 48-51 and 54-57 above, and further in view of Ohsaki et al (U.S. Patent 4,988,580).

JP '531 does not expressly teach that the system comprises a hydrogen separation/ purification region using a metal membrane (claims 12-14) or a pressure-swing adsorption process (claim 15). The reference further does not teach that the reformer employs a partial oxidation reaction (claim 19) or that hydrogen is also produced via electrolysis (claim 20).

Ohsaki et al. is directed to a fuel cell system. The system comprises a purification region (i.e., PSA system or a membrane) that purifies and separates hydrogen (see col. 4, line 5). The hydrogen is produced by steam reforming or partial oxidation (see col. 5, line 20 et seq.). The fuel processor also comprises an electrolyzer (52).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to incorporate these features into the system of JP '531. In column 2, line 8, Ohsaki teaches the following:

> Accordingly, it is an object of the present invention to provide a fuel cell power generating system that operates on hydrogen obtained by reforming natural gas or the like, requiring a reformer having a comparatively small capacity as compared with the peak power demand of the associated load, and capable of efficiently responding to the variation of power demand and making the reformer operate at a maximum efficiency.

Further, regarding the purification processes, the reference teaches at column 4, line 1 that "the gas obtained by the reforming process is purified to obtain a suitable fuel gas for the fuel cell." Regarding the reforming process, the reference teaches at column 5, line 28 that "the reforming process having the adiabatic secondary reforming stage of the partial oxidation method is advantageous because more secondary reformed gas is produced with less consumption of materials." As such, the artisan would be motivated to incorporate the hydrogen generating and purifying methods of Ohsaki in the system of JP '531.

Regarding claim 14, the artisan would be motivated to use palladium as the material of the hydrogen separation membrane. Palladium is well-known for use in such membranes, and the selection of a known material based on its suitability for its intended use has generally been held to be *prima facie* obvious (MPEP §2144.07).

9. Claims 59-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '531 in view of Ohsaki et al.

JP '531 teaches a fuel processor (10), a hydrogen storage tank (50), a mechanical compressor (51) between the processor and the storage device, and a fuel cell stack (30) (see Fig. 1; paragraph [0022] of the machine translation). The fuel cell stack is adapted to simultaneously receive both compressed and uncompressed hydrogen.

JP '531 does not expressly teach that the system comprises a hydrogen separation/ purification region using a metal membrane (claims 59-61) or a pressure-swing adsorption process (claim 62).

Ohsaki et al. is directed to a fuel cell system. The system comprises a purification region (i.e., PSA system or a membrane) that purifies and separates hydrogen (see col. 4, line 5).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to incorporate these features into the system of JP '531. In column 2, line 8, Ohsaki teaches the following:

> Accordingly, it is an object of the present invention to provide a fuel cell power generating system that operates on hydrogen obtained by reforming natural gas or the like, requiring a reformer having a comparatively small capacity as compared with the peak power demand of the associated load, and capable of efficiently responding to the variation of power demand and making the reformer operate at a maximum efficiency.

Further, regarding the purification processes, the reference teaches at column 4, line 1 that "the gas obtained by the reforming process is purified to obtain a suitable fuel gas for the fuel cell." As such, the artisan would be motivated to incorporate the hydrogen purifying methods of Ohsaki in the system of JP '531.

Regarding claim 61, the artisan would be motivated to use palladium as the material of the hydrogen separation membrane. Palladium is well-known for use in such membranes, and the selection of a known material based on its suitability for its intended use has generally been held to be *prima facie* obvious (MPEP §2144.07).

Response to Arguments

10. Applicant's arguments filed June 20, 2005 have been fully considered but they are not persuasive. Applicant generally asserts that JP '531 (Toohata) teaches away from increased size and complexity in its fuel cell system because it "expressly considers increased size (paragraph 0004) and increased heat production and complexity (paragraph 0005) to be problematic in an energy supply system designed for use in a vehicle." However, it is submitted that Toohata does not expressly "teach away" from increased size and complexity, and furthermore, the systems of the reference are not limited to use in a vehicle. In paragraph 0009, the reference discloses that "*[w]hen* such a fuel cell system is used as a system which supplies drive energy of a vehicle..." (emphasis added). Thus, the use of the system in a vehicle appears to be a preferred embodiment of Toohata. Additionally, when the reference discusses increased size, the size is in reference to the size of the hydrogen storage tank (paragraph 0004). Although it is acknowledged that in general, reducing the size and complexity of a fuel cell system can be advantageous, the artisan would be sufficiently skilled to balance the features of the system so as to obtain a system having the needed degree of hydrogen purification, for example. If an artisan were to incorporate

hydrogen purification devices into the system of Toohata, as has been proposed above by the Examiner, the lifespan of the fuel cell would likely be increased; however, the "complexity" of the system would also be increased. The artisan would be sufficiently skilled to balance and optimize these needs. As such, given that Toohata is not believed to expressly teach away from increased complexity, the use of the purification devices of Bloomfield and Ohsaki in the system of Toohata, as set forth in the above rejections, is believed to be obvious to a person of ordinary skill in the art.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (571) 272-1299. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr, can be reached at (571) 272-1414. The phone number for the organization where this application or proceeding is assigned is (571) 272-1700. Documents may be faxed to the central fax server at (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

J. C.

Jonathan Crepeau
Primary Examiner
Art Unit 1746
August 31, 2005